

ST. ANDREWS CREEK BRIDGE
Mount Rainier National Park
Spanning St. Andrews Creek on West Side Road
Longmire Vicinity
Pierce County
Washington

HAER No. WA-51

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HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
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I. INTRODUCTION

Location: Spanning St. Andrews Creek on West Side Road, approximately seven miles north of Nisqually Road, Mount Rainier National Park, Pierce County, Washington.
Quad: Mount Wow, Wash.
UTM: 10/583560/51837310

Date of Construction: 1930-31

Structure type: Stone-faced reinforced concrete filled spandrel arch bridge

Designer and Engineer: Western Regional Office, Bureau of Public Roads, San Francisco, California

Contractor: W.T. Butler Company, Seattle, Washington

Owner: Mount Rainier National Park, National Park Service

Use: Park road bridge (restricted use)

Significance: This structure employs the National Park Service's "rustic style;" the rugged stone veneer conceals its filled reinforced concrete arch construction. This naturalistic treatment allows the bridge to blend into its scenic setting below the Puyallup Glacier and upstream from Denman Falls. Of special interest are several landscape features associated with the bridge, including stone steps leading down from the bridge to the creek and a hiking trail to the nearby waterfall; this trail was constructed by workers from the Emergency Conservation Works program, a Depression-era public relief project. Another trail from the bridge leads to the nearby historic St. Andrews Creek Ranger Station.

Project Information: Documentation of the St. Andrews Creek Bridge is part of the Mount Rainier National Park Roads and Bridges Recording Project, conducted in summer 1992 by the Historic American Engineering Record of the National Park Service.

Richard Quin, HAER Historian, 1992

II. HISTORY

This is one in a series of reports prepared for the Mount Rainier National Park Roads and Bridge Recording Project. HAER No. WA-35, MOUNT RAINIER NATIONAL PARK ROADS AND BRIDGES, contains a general overview of the park roads. In addition, HAER No. WA-122, WEST SIDE ROAD, contains more specific information on the road on which the structure is located.

West Side Road

The West Side Road, built in sections between 1926 and 1935, was originally intended to link the Nisqually Road near the park's southwest entrance with the Carbon River area in the northwest. The road was to be the western link in a projected "round-the-mountain" circuit road system. Work began in 1926 under the supervision of the Bureau of Public Roads. However, a change in Park Service policy dictated that the north and northwest sections of the park would be left as roadless areas, and the West Side Road project was halted in 1935. Only about half the contemplated length of road was completed.

The 12.5-mile road leaves the Nisqually Road one mile east of the Nisqually Entrance. It runs northeast and north for roughly three miles on a bench above the west bank of Tahoma Creek, then along the west side of Fieh Creek. The road crosses the creek and continues north to Tahoma Vista, and veers west and then north again on a series of looping curves and switchbacks to Round Pass, nine miles north of the Nisqually Road. From Round Pass, the road then on a sharp long switchback to the South Puyallup River Bridge [HAER No. WA-52]. The West Side Road then continues generally northwest to St. Andrews Creek and a mile further to the present road terminus at Klapatche Ridge. The road originally continued east another two and half miles to the North Puyallup River, but this section has been closed to vehicles and is now the North Puyallup Trail.

Following a recurring series of debris flows on Tahoma Creek, the West Side Road was closed to public travel at Fieh Creek in 1989. The road is open in rough condition through the flood-prone area but access is limited to official vehicles. The National Park Service is presently [1992] deciding whether or not to reopen the road.

St. Andrews Creek Bridge

Seven miles north of the junction with the Nisqually Road, the West Side Road spans St. Andrews Creek on a "rustic style" stone faced semicircular arch bridge. Like most of the other arch bridges in Mount Rainier National Park, the St. Andrews Creek Bridge is actually a filled reinforced concrete barrel arch structure, clad in granite stone so as to harmonize with the landscape. The bridge was constructed in 1930 and 1931 on the Round Pass-Klapatche Ridge section under a contract separate from the roadway construction; this contract also included the construction of the nearby South Puyallup River Bridge [HAER No. WA-52]. Much of the road work on this section, including the construction of a temporary bridge, was complete by the time the contract for the permanent bridge was awarded.

The first surveys for the West Side Road were undertaken by the National Park Service in the early 1920s. These were taken over by the Bureau of Public Roads (BPR), which in 1925 assumed responsibility for major park road projects. The location for the St. Andrews Creek Bridge was determined by BPR Resident Engineer C. R. Short in September 1925. In his monthly report to the BPR district office, Short described the location: "We have a good location for a short, masonry arch, good rock foundation and beautiful setting. The

bridge will be about 400 ft. above the falls* and the roar of the falling water may be heard from the road. The location of the road at the crossing of St. Andrews Creek will naturally aid in the development of the proposed camp site.**

The National Park Service's Division of Landscape Architecture determined that a stone-faced reinforced concrete arch bridge was suitable for the crossing. The Bureau of Public Roads was asked to prepare plans and specifications for the structure. SPR engineers prepared the construction drawings in the bureau's San Francisco regional office in December 1929.² The architectural sheets, showing general design details, were prepared by the Landscape Architecture Division.³ Mount Rainier National Park Superintendent O. A. Tomlinson approved the plans in March 1930.⁴ Following final approval by the Park Service's Washington office and the Department of the Interior, the project was advertised as a joint contract with the construction of a nearby span over the South Puyallup River.

Bids for the project were opened at the District 1 office of the Bureau of Public Roads in Portland, Oregon on 7 June 1930. The joint contract was awarded on 15 July to the W. T. Butler Company of Seattle, which had submitted the low bid of \$36,580. This was considerably less than the engineers' estimate of \$50,313.50 for construction costs.⁵ Butler established his construction camp in late July and began excavation work at the St. Andrews Creek site.⁶

An early change order dictated that the existing temporary bridge at the site be removed and replaced with one located directly over the permanent bridge site. This was necessary in order to protect the landscape from scars which would have been caused by construction of the detour road to the existing temporary bridge site. The new temporary span was included in the Butler contract. Specifications indicate that it was to be at least 14' in width and strong enough to carry 35 tons. The project engineer estimated the cost of the removal of the old structure and construction of the new temporary span at \$5,000.⁷

Bureau of Public Roads engineers developed specifications for the permanent bridge, estimating that the following materials would be required:

Class "B" concrete	82 cu. yds.
Class "C" concrete	50 cu. yds.
Reinforcing steel	11,000 lbs.
Arch ring facing	48 sq. yds.
Cement rubble masonry	600 cu. yds.
Structural excavation (removed)	550 cu. yds.
Curb stones	116 lin. ft.
Membrane waterproofing	175 sq. yds. ⁸

As the above quantities were only estimates, it is likely that they were adjusted due to field requirements.

In contrast to most of the other bridges in the park, which utilized native stone for the masonry, the contractor made arrangements to purchase cut

* Denman Falls.

** Except for a later work camp established by the Emergency Conservation Works program, no camp was evidently located at the St. Andrews site. The reference may refer to the camp site at Klapatche Park, 2.5 miles east.

granite from Index, Washington, north of Mount Rainier on the edge of the Mount Baker-Snoqualmie National Forest, and to ship the stone by truck to the bridge site. The contractor insisted that the stone could be obtained cheaper than by quarrying inside the park.⁹

Construction began with the excavation for the abutments. After the concrete was poured, the reinforcing steel was erected on timber falsework. All steel consisted of deformed bars of $\frac{1}{2}$ " diameter dimension. The horizontal bars were irregularly spaced, and the vertical bars on 6" and 12" centers. Transverse bars were placed on 2' centers. All bars rested on hooped stirrups. Next, the arch ring stones or voussoirs were placed. These stones were specified in the architectural drawings prepared by the National Park Service Division of Landscape Architecture, and were cut to size from wooden templates. The stones were fitted with $1\frac{1}{4}$ " x 2'8" diameter steel cramps which helped the stones bond with the concrete poured next.¹⁰ By the end of September, the contractor had finished the placing of the arch ring stones and the construction of the masonry wing walls. Formwork for pouring the concrete arch was in place.¹¹

The arch footings utilized the Class "C" concrete (1:2.5:5 mix) while the arch barrel and spandrel walls used a Class "B" (1:2:4) mix. The top of the arch barrel and the inside surfaces of the concrete spandrel walls were covered with a membrane waterproofing. The following pouring schedule was observed: First, the concrete for the abutments was placed. Next came the pouring of the arch haunches, followed by the crown. Afterwards, a stepped section above the haunches was poured, and last, a second pour went over the crown. A $\frac{1}{2}$ " expansion joint separated the last two pours, and construction joints or keys were specified between the abutment and the arch haunch sections. The specifications indicated that the arch ring stones were to be placed between pours one and two, and that all concrete was to cure at least three days before an adjacent section was poured.¹²

After the pouring of the concrete arch, the stone spandrel walls were constructed. Each was provided with a $\frac{3}{4}$ " inch expansion joint packed with asphaltic filler with the exposed joint painted with cement mortar. The wing walls were constructed next; these were built of matching masonry on a 5:12 batter. The compacted earth fill was then placed, followed by the 9" wide by 20" high curb stones for the sidewalks. The stone guard railing was constructed last.¹³ The architectural plans specified that stones for the rail should be large enough to extend the full width of the rail. The same plans also dictated the use of weathered stones for all exposed surfaces.¹⁴ The crushed gravel surfacing was applied under a separate contract. This bridge and the South Puyallup River span were completed 17 August 1931. Total cost of the joint contract for the two bridges, including BPR engineering fees, was \$41,985.94.¹⁵

Following completion of the St. Andrews Creek Bridge, two sets of stone guard walls connecting with the bridge railing and two sets of stone steps leading from the bridge to the creek level were constructed under a separate contract. This work was done by contractors Myers & Coulter under a combined contract with grading work on the next section of road extending as far as the North Puyallup River, surfacing with crushed rock all graded sections as far north as the same crossing, and construction of two parking areas at the North Puyallup. Myers and Coulter began work on 18 May 1931. The masonry work was sublet to a mason named Carl Youngquist, who commenced work on 6 July 1932 with a crew of three masons, three helpers, two quarry men, a mortar mixer and a man hauling rock. This work was completed on 6 October 1932 and the BPR resident engineer appraised the work as "first-rate."¹⁶

In May 1933, the Emergency Conservation Works (ECW) program, a division of the Civilian Conservation Corps public relief project, established work camps N.P.1 at Tahoma Creek and N.P.4 at St. Andrews Creek. Over the next several years, ECW workers assisted with roadside cleanup and highway maintenance for the new West Side Road.¹⁷ As part of their work, the workers constructed the foot trail from St. Andrews Creek Bridge to Denman Falls.

A September 1975 inspection by the Federal Highway Administration reported the bridge in "good condition throughout," requiring no special maintenance. The report stipulated that approach alignment was less than desirable and the masonry guard rail did not meet current AASHTO specifications. Vegetation should be removed from the deck and rails. The H15 load, designed to bear two 15-ton trucks, was considered adequate for the existing traffic.¹⁸

The St. Andrews Creek Bridge remained in constant use until 1989, when the West Side Road was closed to public travel due to flood damage along Tahoma Creek. The road and bridge remain passable, but use is limited to official vehicles. Vegetation is now growing on the deck margins, and logs were wedged against the upstream face at the time of a site visit in October 1992; nevertheless, the structure appeared in good overall condition. Park road crews apparently keep the bridge maintained despite the closure of the road.

Description

St. Andrews Creek Bridge is a stone-faced reinforced concrete filled spandrel arch structure, 115' in length and 34' 4" wide. The structure carries a double-lane roadway 26' wide and a 4' sidewalk on the east or upstream side. The structure spans St. Andrews Creek on a single filled semicircular arch with a clear span of 26' and a rise from the spring line of 13'. The concrete stub abutments are built on skew back foundations resting on solid rock. The structure is built on a 26° curve and is superelevated from 0.1' per foot rising from west to east. It is also skewed 17°30' from northwest to southeast. The downstream walls above the arch are 7' high, rising to 9' 4" on the upstream face. The bridge is surfaced with 6" of compacted crushed rock.

Broken range masonry guard walls extending north from the bridge form the border of a small parking turnout for use by visitors and hikers. Sets of stone steps descend from the northeast and southwest corners of the bridge to St. Andrews Creek. These allow the visitor, perhaps a motorist parking at the turnout, to wander down to the bubbling brook, where the fine lines of the arched bridge may be observed. These steps receive little use today and are largely overgrown.

The bridge is located in a very damp mixed conifer zone at an elevation of 3700'. From the northeast corner of the bridge, the St. Andrews Creek trail leads to a connection with the Wonderland Trail and the high subalpine meadows of St. Andrews Park. A short spur trail leads to the St. Andrews Creek Ranger Station, now used by backcountry rangers during the summer season. This small rustic style log structure, built in 1922, is one of the oldest patrol cabins in Mount Rainier National Park. Another trail from the southwest corner of the bridge leads two-tenths of a mile to an overlook at the exceeding beautiful Denman Falls, and then meanders on, in a wild and unmaintained state, to Ethania and Larrupin Falls.

Due to the closure of the West Side Road in 1989, only a few official vehicles pass over the bridge each year. The bridge is cloaked with mosses and lichens, and plants are beginning to take root on the edges of the deck. However, the structure appears to be in excellent condition.

III. ENDNOTES

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2. U.S. Department of Agriculture, Bureau of Public Roads, "Plans for Proposed Project 2-A, B1, South Puyallup River & St. Andrews Creek Bridges, Sec. A-Southwest Entrance-Round Pass; Sec. B-Round Pass-Klapatche Ridge, Route No. 2-West Side Highway, Mt. Rainier National Park Highway System, Washington," Construction drawings RG 177 A&B, 2 sheets (San Francisco, CA: Bureau of Public Roads, December 1929). Engineering Division files, Mount Rainier National Park.
3. U.S. Department of the Interior, National Park Service, Division of Landscape Architecture, "Architectural Plans, St. Andrews Creek Bridge, Mt. Rainier National Park," construction drawing PG 177 (San Francisco, CA: National Park Service, Division of Landscape Architecture, 8 March 1930). Engineering Division files, Mount Rainier National Park.
4. Tomlinson, Superintendent's Monthly Report, March 1930, 4. MORA Archives, Box H2615, Superintendents' Monthly Reports 1926-1932 file.
5. Idem, Superintendent's Monthly Report, June 1930, 9. MORA Archives, Box H2615, Superintendents' Monthly Reports 1926-1932 file; Jos. M. Dixon, First Assistant Secretary of the Interior, to W. T. Butler Company, Seattle, WA, 15 July 1930. National Archives, RG 48, Box 1991, File 12/7, Mount Rainier National Park contracts.
6. Tomlinson, Superintendent's Monthly Report, July 1930, 13. MORA Archives, Box H2615, Superintendents' Monthly Reports 1926-1932 file.
7. J. S. Bright, Construction Engineer, for L. I. Hewes, Deputy Chief Engineer, Bureau of Public Roads, to O. A. Tomlinson, Superintendent, Mount Rainier National Park, 7 June 1931, attachment; "Engineer's Estimate for Proposed F.Y. 1931 Construction," attached to Ibid.. National Archives, RG 48, Box 1991, File 12/7, Mount Rainier National Park contracts.
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10. See U.S. Department of Agriculture, Bureau of Public Roads, "General Details, St. Andrews Creek Bridge, West Side Road, Rainier National Park Project 2-B-1," Construction drawing RG 177-B (San Francisco, CA: Bureau of Public Roads, December 1929). Engineering Division files, Mount Rainier National Park.
11. Tomlinson, Superintendent's Monthly Report, September 1930, 7. MORA Archives, Box H2615, Superintendents' Monthly Reports 1926-1932 file.

12. *Ibid.*

13. *Ibid.*

14. See NPS construction drawing PG 177.

15. Tomlinson, Superintendent's Annual Report, 1931, 13. MORA Archives, Box H2621, Superintendents' Annual Reports 1926-1932 file; W. H. Lynch, District Engineer, Bureau of Public Roads, Portland, OR, to Chief, Bureau of Public Roads, Washington, D.C., 1 July 1932. MORA Archives, File D22, Construction Program 1932-1935.

16. Tomlinson, Superintendent's Annual Report, 1931, 13; C. G. Polk, Assistant Highway Engineer, Bureau of Public Roads, "Final Construction Report (1931-1932) on West Side Highway, Project No. 2-B, C1 (Portion), Grading, Surfacing and Guardrails, Mt. Rainier National Park, County of Pierce, State of Washington (Portland, OR: Bureau of Public Roads, 1932), 3, 9-10.

17. M. J. Pike, Project Superintendent, Tahoma Creek Camp, Emergency Conservation Works, "Camp N.P.1, Tahoma, Mt. Rainier National Park, Narrative Report, Fifth Enrollment Period, 1935," (Mount Rainier National Park: National Park Service, 1935), 1-2; C. E. Drysdale, Supervising Engineer, Emergency Conservation Works, "Final Report on E.C.W. Activities, Third Enrollment Period, Season of 1934," 43-44. MORA Archives, File H14, ECW Activities.

18. U.S. Department of Transportation, Federal Highway Administration, "Bridge Safety Inspection Report, St. Andrews Creek Bridge, Mt. Rainier National Park, Structure No. 9450-029P" (Denver, CO: Federal Highway Administration, Region 8 Office of Western Bridge Design, September 1975), 1.

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